

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

PCT

To:

see form PCT/ISA/220

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY (PCT Rule 43bis.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.
PCT/JP2004/003774

International filing date (day/month/year)
19.03.2004

Priority date (day/month/year)
20.03.2003

International Patent Classification (IPC) or both national classification and IPC
C04B35/488, H01M8/12

Applicant
NISSAN MOTOR CO., LTD.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☒ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA"). However, this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of three months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

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**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/JP2004/003774

Box No. I Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.
☐ This opinion has been established on the basis of a translation from the original language into the following language , which is the language of a translation furnished for the purposes of international search (under Rules 12.3 and 23.1(b)).
2. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:
 - a. type of material:
☐ a sequence listing
☐ table(s) related to the sequence listing
 - b. format of material:
☐ in written format
☐ in computer readable form
 - c. time of filing/furnishing:
☐ contained in the international application as filed.
☐ filed together with the international application in computer readable form.
☐ furnished subsequently to this Authority for the purposes of search.
3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.
4. Additional comments:

**WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY**

International application No.
PCT/JP2004/003774

Box No. II Priority

1. ☒ The following document has not been furnished:
- ☒ copy of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(a)).
 - ☐ translation of the earlier application whose priority has been claimed (Rule 43*bis*.1 and 66.7(b)).
- Consequently it has not been possible to consider the validity of the priority claim. This opinion has nevertheless been established on the assumption that the relevant date is the claimed priority date.
2. ☐ This opinion has been established as if no priority had been claimed due to the fact that the priority claim has been found invalid (Rules 43*bis*.1 and 64.1). Thus for the purposes of this opinion, the international filing date indicated above is considered to be the relevant date.
3. Additional observations, if necessary:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-11
	No: Claims	12
Inventive step (IS)	Yes: Claims	1-11
	No: Claims	12
Industrial applicability (IA)	Yes: Claims	1-12
	No: Claims	-

2. Citations and explanations

see separate sheet

Section V

1. Reference is made to the following documents:

- D1: BADWAL S P S ET AL: "Scandia-zirconia electrolytes for intermediate temperature solid oxide fuel cell operation" SOLID STATE IONICS, NORTH HOLLAND PUB. COMPANY. AMSTERDAM, NL, vol. 136-137, 2 November 2000 (2000-11-02), pages 91-99, XP004225912 ISSN: 0167-2738
- D2: PATENT ABSTRACTS OF JAPAN vol. 1995, no. 06, 31 July 1995 (1995-07-31) -& JP 7 073891 A (TOHO GAS CO LTD), 17 March 1995 (1995-03-17)
- D3: DATABASE WPI Section Ch, Week 198141 Derwent Publications Ltd., London, GB; Class E36, AN 1981-74991D XP002283581 -& JP 56 109871 A (TOYOTA JIDOSHA KK) 31 August 1981 (1981-08-31)
- D4: US-A-4 205 051 (SUZUKI YUTAKA ET AL) 27 May 1980 (1980-05-27)
- D5: DATABASE CHEMABS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; TAKEUCHI, TOMONARI ET AL: "Improvement of mechanical strength of 8 mol% yttria-stabilized zirconia ceramics by spark-plasma sintering" XP002283582 retrieved from STN Database accession no. 2002:316802

2. The subject-matter of claim 12 appears to be not new (Art.33(2) PCT). The reasoning is as follows:

- 2.1 Claim 12 is directed towards a solid electrolyte having a composition expressed by the formula: $(1-x) \text{ZrO}_2 + x\text{Sc}_2\text{O}_3$ (where x is 0.05-0.15) and having at least 90% cubic phase and less than 10% β -phase. Further product features, implied by specifying that a spark plasma method was used, are not apparent.

Document D1 (whole document, in particular "Results and Discussion" and "Conclusions") discloses cubic phase $\text{ZrO}_2 + \text{Sc}_2\text{O}_3$ solid electrolytes, with 9.0, 9.3 and 9.5 mol% Sc_2O_3 . Only, the compositions with 10.0 and 11.0 mol% Sc_2O_3 were found to exhibit the β -phase after sintering. The maximum stability and conductivity was found for the composition with 9.3 mol% Sc_2O_3 .

Thus, D1 appears to be prejudicial to the novelty of claim 12.

- 2.2 Document D2 (abstract, figure 2, paragraph 0019) also appears to show a $\text{ZrO}_2 + \text{Sc}_2\text{O}_3$ solid electrolyte, with 8 mol% Sc_2O_3 , having a cubic structure.

Thus, D2 appears to be prejudicial to the novelty of claim 12.

- 2.3 Document D3 (abstract, table 3, figures) also appears to disclose $\text{ZrO}_2 + \text{Sc}_2\text{O}_3$ solid electrolytes, having a cubic structure, and having 8, 9 and 10 mol% Sc_2O_3 .

Thus, D3 appears to be prejudicial to the novelty of claim 12.

- 2.4 Document D4 (reference example 1) discloses $\text{ZrO}_2 + \text{Sc}_2\text{O}_3$ solid electrolytes, having a cubic structure, and having 8, 9 and 10 mol% Sc_2O_3 .

3. The process according to claim 1 appears to fulfil the requirements of Articles 33(2) and 33(3) PCT. The reasoning is as follows:

- 3.1 None of the prior art documents discloses a process for preparing $\text{ZrO}_2 + \text{Sc}_2\text{O}_3$ solid electrolytes, which involves spark plasma sintering. Document D5 describes spark plasma sintering of yttria-stabilised zirconia, but makes no mention of scandia. Thus, the subject-matter of claims 1-11 appears to be new (Art. 33(2) PCT).

- 3.2 The technical problem solved by the process according to claim 1 can be formulated thus: "how to provide cubic phase $(1-x) \text{ZrO}_2 + x\text{Sc}_2\text{O}_3$ solid electrolytes in the compositional range $x = 0.05 - 0.15$." In D1-D4, and in D1 in particular, cubic phase $(1-x) \text{ZrO}_2 + x\text{Sc}_2\text{O}_3$ solid electrolytes in the compositional range $x = 0.08 - 0.10$ could be prepared, using conventional sintering. However, there are no indications in D1-D4, which would cause a person skilled in the art to combine any of D1-D4 with D5 in order to solve the problem solved by the process according to claim 1.